

An uncharacteristic new population of the Mountain Pygmy-possum *Burramys parvus* in New South Wales

Martin Schulz^{1, 4}, Gabriel Wilks² and Linda Broome³

¹ Australian Museum Business Services, 6 College St., Sydney, NSW, 2010.

² Office of Environment and Heritage, P.O. Box 472, Tumut, NSW, 2720.

³ Office of Environment and Heritage, P.O. Box 733, Queanbeyan, NSW, 2620

⁴ 34 Wilford St. Corrimal, NSW, 2518.

Corresponding Author: antarcticmartin@gmail.com

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The Mountain Pygmy-possum *Burramys parvus* was first described from a fossil found in Wombeyan Caves, central-eastern New South Wales in 1895, with further fossils located in Buchan Caves in eastern Victoria and Jenolan Caves in central-eastern New South Wales (Broom 1896; Wakefield 1960; Hope 1982). In August 1966 a living individual was located in the University Ski Lodge on Mt Higginbotham in the Victorian Alps (Ride 1970; Dixon 1971). The first discovery of the species in New South Wales was an individual trapped in Kosciuszko National Park in early 1970 (Calaby *et al.* 1971). Over the next three decades *Burramys parvus* was located in three regional populations that were separated by low elevation river valleys in the subalpine and alpine areas of south-eastern Australia. These regional populations are located in Kosciuszko National Park in New South Wales, the Bogong High Plains area (including sub-populations on Mt Bogong, the Bogong High Plains and Mt Higginbotham) and at Mt Buller in Victoria. Highest densities and breeding females are largely confined to periglacial blockfields and blockstreams (termed boulderfields) at altitudes above 1400 m in Victoria and 1600 m in New South Wales (Caughley 1986; Mansergh and Broome 1994; Heinze and Williams 1998; Osborne *et al.* 2000; Heinze *et al.* 2004; Broome *et al.* 2005). The lower altitudinal limit roughly corresponds with the winter snowline of around 1370 m in altitude (Davis 1998). The New South Wales population was recently estimated at 613 ± 92 individuals (Broome *et al.* 2005) and is restricted to small patches of preferred boulderfield habitat between South Ramshead in the Thredbo area north to Gungartan Pass in southern Kosciuszko National Park in an area measuring 30 km by 8 km (Caughley 1986; NSW National Parks and Wildlife Service 2002; Broome *et al.* 2005). As a result of the small population size, extremely restricted distribution and threats associated with ski-run development *Burramys parvus* has been listed as Endangered under both the Federal *Environment Protection and Biodiversity Conservation Act* 1999 and the New South Wales *Threatened Species Conservation Act* 1995.

Happy Jacks Valley contains a series of major disturbances including the deposit of large volumes of granitic tunnel spoil resulting from the construction of the Eucumbene – Tumut Tunnel as part of the Snowy Mountains Hydro-electric Scheme in the 1950s. These major disturbances are proposed for rehabilitation works by the National Parks and Wildlife Service as part of a larger program funded by Snowy Hydro Limited to address environmental and safety risks related to Snowy Scheme construction across Kosciuszko National Park. In November 2010 a fauna survey was conducted based around these major disturbances in the Happy Jacks Valley as part of the initial planning and assessment process (Schulz 2010). This area is situated approximately 32 km north of Gungartan Pass in northern Kosciuszko National Park, the most northerly known *Burramys parvus* location.

As part of the November 2010 survey, four Elliott A traplines comprising 20 traps each baited with walnut pieces were set for four consecutive nights for a total of 80 trapnights (Table 1). This trapping resulted in the surprise capture of two *Burramys parvus* adult females, each with four young present in the pouch, on the crest of Happy Jacks Spoil Dump 1 (termed Site HJ05) at an altitude of 1220 and 1230 m respectively. The two females were trapped approximately 80 m apart (AMG 55-630696/6014955 ± 10 m and 630693/6014991 ± 7 m) on 10 and 11 November respectively. In the same survey period no *Burramys parvus* were captured in 100 trap nights across the lower sections of the same spoil dump up to 50 m upslope of the Tumut River. Additionally, in the November survey a small individual was spotlighted midway across Happy Jacks bridge (AMG 55-630778/6014571 ± 5 m) at 2315 hours on 11 November 2010 at an altitude of 1200 m.

In January 2011, 12 trapping transects were established in and on the edge of spoil dumps using the same trapping technique as the November survey (Table 1; Schulz 2011). Additionally, two sites were sampled on modified natural scree along Happy Jacks Road within 1 km of the nearest major disturbance site. In a total of 1272 trap nights, 11 individuals were captured, comprising

Table 1. Summary of *Burramys parvus* trapping in Happy Jacks Valley.

Area	Grid Reference (AGD 66, Zone 55)	Trap-nights	<i>Burramys</i> captures	Trapping Success (per 100 trapnights)
November 2010 Survey				
Upper access track, crest of Happy Jacks Spoil Dump 1	630697/6014909	80	2	2.5
Lower section Happy Jacks Spoil Dump 1	630907/6014804	80	0	0
Upper slope of Spoil Dump 3	631541/6014952	80	0	0
Upper scree slope below Happy Jacks Quarry	632597/6012595	80	0	0
January 2011 Survey				
Upper access track, crest of Happy Jacks Spoil Dump 1	630697/6014909	100	1	1.0
Lower access track, crest of Happy Jacks Spoil Dump 1	630641/6014701	104	0	0
Upper edge of Happy Jacks Spoil Dump 1	630603/6015113	100	0	0
Around back of large flat area on crest of Happy Jacks Spoil Dump 1	630759/6015112	100	0	0
North side of Happy Jacks Road bridge	630758/6014509	100	0	0
South side of Happy Jacks Road bridge	630773/6014563	48	0	0
Across Happy Jacks Spoil Dump 2	631059/6014654	80	0	0
Base of middle section of Happy Jacks Spoil Dump 3	631537/6015016	80	0	0
Base of southern section of Happy Jacks Spoil Dump 3	631568/6014919	100	0	0
Base and lower sections of Happy Jacks Spoil Dump 4	631424/6014589	80	1	1.25
Lower section of Happy Jacks Generator Site Spoil Dump	631249/6014579	80	0	0
Lower scree slope below Happy Jacks Quarry	631059/6014654	100	1	1.0
Edge of Happy Jacks Road and adjacent natural scree south of Wuthering Heights Road junction	631413/6014174	100	8	8.0
Large scree slope above Happy Jacks Road south of Wuthering Heights Road junction	631560/6013813	100	0	0
Total (both survey periods combined)		1592	13	0.82

four adult males, four immature males and one immature female at altitudes ranging between 1220 and 1310 m:

- one immature male was captured in exactly the same trapping location as the first adult female trapped in the November survey on the upper access track adjacent to the crest of Happy Jacks Spoil Dump1 (Site HJ05);
- a single immature male was captured in a trap set in a deep recess at the base of Spoil Dump 4 (AMG 55-631423/6014592 $\pm$ 5 m) at an altitude of 1280 m (Site HJ19);
- one immature male was captured amongst large boulders with numerous interspaces of varying size below the Happy Jacks Quarry 20 m upslope of Happy Jacks Creek (AMG 55-632586/6012676 $\pm$ 5 m) at an altitude of 1310 m (Site HJ28). During the November survey, no *Burramys parvus* were captured in 100 trap nights across the upper sections of this scree area.
- eight captures were made in traps set within 20 m of each other (centred on AMG 55-631416/6014173 $\pm$ 6 m) on a small section of natural shallow scree slope located 20 to 30 m below Happy Jacks Road at an altitude of 1290 m in 28 trap nights at a capture rate of 28.6 individuals per 100 trap nights for this component of the trapline, including one adult male recaptured on two occasions in the same trap (Site HJ26).

Other mammal species trapped in the Happy Jacks Valley area were the Agile Antechinus *Antechinus agilis*, Bush Rat *Rattus fuscipes* and Dusky Antechinus *Antechinus swainsonii*. *Burramys parvus* was the second most frequently trapped species in the November survey comprising 12.5% of captures behind the Bush Rat (81% of captures). While it was the third most commonly trapped mammal species in the January survey, comprising 18.3% of total captures behind the Agile Antechinus (38.3% of captures) and the Bush Rat (28.3% of captures).

The presence of *Burramys parvus* in the Happy Jacks Valley is atypical of all other known extant populations (e.g. Mansergh and Broome 1994; NSW National Parks and Wildlife Service 2002; Heinze *et al.* 2004; Broome *et al.* 2005). The Happy Jacks Valley localities were situated outside the BIOCLIM predicted distribution, with the closest suitable habitat mapped as occurring in the Mt Jagungal area some 18 km to the south west (Broome *et al.* 2005). All sites identified within Happy Jacks Valley were comprised of artificial or modified habitats at altitudes ranging from 1200 to 1310 m well below the 1600 m lower elevation limit of known breeding populations in southern Kosciuszko National Park (Heinze *et al.* 2004; Broome *et al.* 2005). Radiotracked females as well as males and juveniles have been recorded as low as 1300 m at Mt Buller and a juvenile was captured by one of the authors (M. Schulz) at similar elevations at Falls

Creek (Heinze et al. 2004; M. Schulz unpublished obs.). However, records have not been obtained below 1380 m in NSW (Dimple and Calaby 1972; Mansergh and Broome 1994; L. Broome unpublished records). Further, these sites lacked the typical boulderfield characteristics of periglacial blockfields and blockstreams (as described by Rosengren and Petersen 1989) and associated alpine shrubby heathland as indicated by the absence of the Mountain Plum-pine *Podocarpus lawrencei*, which forms an important component of the diet of *Burramys parvus* (Gullan and Norris 1984; Smith and Broome 1992; Gibson 2007). Instead the habitat at all of these sites was modified and/or artificial with two sites in the latter situations (31% of total captures) being on a spoil dump and along a road cutting at the edge of a spoil dump in Snow Gum *Eucalyptus pauciflora* sens. lat. dominated woodland (Table 2). The other two sites were comprised of modified scree habitat; either shallow scree supplemented with material bulldozed during road clearing operations from Happy Jacks Road 20 to 30 m above the site or large boulder-sized blocks supplemented with material bulldozed from the upslope quarry. Despite the atypical habitats, the location of adult females with young and adult males suggests the Happy Jacks Valley either supports a resident population or encompasses a section of habitat occupied by a resident population that extends further upslope above the valley into more typical boulderfield habitat which occurs on the upper western slopes of Bolton's Hill (extending to an altitude of 1634 m).

Since the results reported here, *Burramys parvus* has been located on the upper western slopes of Bolton's Hill above Happy Jacks Valley (1400 to 1634 m). Populations have also been found in characteristic boulderfield habitat in the Rough Creek headwaters (1500 to 1650 m) and at Snow Ridge, south of Cabramurra (1430 to 1530

m), approximately 4 km and 7 km respectively from the Happy Jacks Valley sites (L. Broome and H. Bates unpublished data).

The lack of trapped adult females in January may have been as a result of a greater home range at the low altitude of the Happy Jacks Valley sites. Such a trend was found in the Mt Blue Cow area where it was suggested to be in response to declining numbers of Bogong Moths *Agrotis infusa* at lower elevations, and the concentration of moths in high elevation as the summer progressed (Broome 2001a). Large numbers of Bogong Moths are an important habitat feature of high quality *Burramys parvus* sites (Broome 2001a; Heinze et al. 2004). Although no moth sampling was conducted in the present survey, few active moths were observed during spotlight surveys or sheltering under rocks or in cracks and recesses during diurnal reptile searches of the trapping sites (Schulz 2010, 2011). Broome and Bates (unpublished data) detected few moths using moth light traps at the Happy Jacks Spoil Dump 1 site in December and January but in contrast high numbers were sampled on Bolton's Hill, Snow Ridge and in the Rough Creek headwaters.

The characteristic boulderfield habitat on Bolton's Hill and the surrounding area north of Happy Jacks Creek was very severely burnt during the 2003 bushfires, resulting in the loss of all vegetation including key food plant species, in particular the Mountain Plum-pine. Currently, there is little evidence of regenerating Plum-pine but alternative potential food sources are present, such as seeds of the Tall Rice Flower *Pimelia ligustrina* and other alpine shrubs that have recovered well from the wildfire; Native Raspberry *Rubus* spp.; and invertebrates such as beetles, caterpillars and spiders are abundant (H. Bates and L. Broome unpublished data). In addition, a good cover of snow in winter 2010 may be enabling *Burramys parvus* to persist at the lower altitudes.

Table 2. Summary of *Burramys parvus* trap site habitat characteristics, Happy Jacks Valley.

Site	Type	Site Characteristics
Artificial	HJ05 Road cutting below low cliff or spoil and upslope of spoil dump over 100 m in altitude	Adult female and immature male captured under fallen branches of dead Snow Gum amongst shallow rock rubble in Snow Gum woodland regenerating after the 2003 wildfire. Second adult female captured on edge of spoil dump slope above access track in open Snow Gum-dominated woodland.
	HJ19 Base of spoil dump	One immature male captured in a more stable section of the spoil dump (as indicated by the growth of moss) amongst rocks of larger size within 1 m of the ecotone of regenerating Snow Gum woodland following the 2003 wildfire.
Modified	HJ28 Base of deep scree comprising large boulders with scattered pieces of metal from the quarry above.	One immature male was captured in a large boulder scree 30 m from the ecotone of alpine shrubland and 20 m above the Happy Jacks Creek, with no emergent vegetation or moss present and widely spaced growths of lichen.
	HJ26 Small area of scree modified by material bulldozed downslope from road above	Eight captures in small shallow scree area in stable section of the slope (as indicated by the presence of Native Raspberry <i>Rubus parvifolius</i> growing in the interspaces) amongst rocks of larger size within 1 to 9 m upslope from the ecotone of grassland, with scattered weeds (e.g. Woolly Mullein <i>Verbascum thapsus</i> and Viper's Bugloss <i>Echium vulgare</i>), and scattered shrubs (including <i>Senecio</i> sp., Royal Grevillea <i>Grevillea victoriae</i> and Elderberry <i>Panax Polyscias sambucifolius</i>) or Snow Gum / Black Sallee <i>E. stellulata</i> woodland.

However, with the exception of Happy Jacks Spoil Dump 1 (1.5 km south east of Bolton's Hill) all trapping locations were situated on the opposite side of the Happy Jacks Creek to Bolton's Hill. Whether these individuals are part of the Bolton's Hill population and are able to cross the creek or are part of a more widespread population on the southern side of the creek (parts of which were not burnt in 2003) that include boulderfields on the ridge south west of the creek and tributaries of Dodger Creek possibly extending to suitable habitat in Trapyard Creek, Fifteen Mile Creek and Rough Creek valleys all situated within 3 to 4 km of Happy Jacks Valley and within the range of movement of males and juveniles (Broome 2001 a, b), or are part of a low density population that does not use typical boulderfield habitat needs to be determined.

No population estimate of *Burramys parvus* in Happy Jacks Valley was calculated due to the range of habitats occupied (Table 2). Further studies including an assessment of site usage and the identification and delineation of key habitat variables within the extensive natural boulderfields located above Happy Jacks Valley on Bolton's Hill, low elevation natural habitat and artificial environments such as spoil dumps in the valley, using trapping and radio telemetry is required before a reliable assessment of local movements and a population size estimate can be made.

The location of *Burramys parvus* in atypical habitat approximately 32 km north of the previously most northern extent of its range suggests that there are further populations awaiting discovery both within Kosciuszko National Park and possibly even in other parts of the Australian Alps. It is likely that more populations between Gungahran Pass and Happy Jacks Valley await discovery, despite past trapping in the Mt Jagungal area which failed to locate the species (Broome *et al.* 2005; L. Broome 2009 unpublished data). Additionally, it is possible that *Burramys parvus* may occur elsewhere in atypical habitat at altitudes below the winter snow line of around 1370 m. Therefore, it is important that all high country fauna surveys in the Australian Alps region incorporate suitable techniques for the location of this species, even in situations not regarded as normal habitat for *Burramys parvus*. In such sites densities may be low and therefore to detect the species trapping effort would need to be high and be conducted during the 'active season' from October to April (after Mansergh and Scotts 1990). Further, the natural history of the population in this atypical location is worthy of further study to provide an understanding that will assist with effective management in an area displaying a different set of environmental characteristics to those considered in published recovery plans and related documents (e.g. Mansergh *et al.* 1989, 1991; NSW National Parks and Wildlife Service 2002; Heinze 2005) and will assist in the understanding and protection of the species as a whole.

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APPENDIX I



Typical *Burramys parvus* boulderfield habitat at Snowridge near Cabramurra with Mountain Plum-pine in the foreground.

Photo, M. Schulz



Site of the first capture of female with young on the edge of the access track on the crest of Happy Jacks Spoil Dump I.

Photo, M. Schulz

APPENDIX I



Capture site of immature male at base of Happy Jacks Spoil Dump 4.
Photo, M. Schulz



Immature male capture site at base of Happy Jacks Quarry just above Happy Jacks Creek.
Photo, M. Schulz



Eight captures were made in the modified natural shallow scree below Happy Jacks Road.
Photo, M. Schulz

APPENDIX 2

